North Cayo Puerca – Station 5

Submerged roots of Red Mangrove (*Rhizophora mangle*) were found along both sides of the channel separating Cayo Puerca from Punta Colchones (Figure 2). Our study was focused on the mangrove communities of Cayo Puerca, on the western side of the channel. Submerged sections of mangrove roots ranged from only a few centimeters at the surface to a maximum depth of approximately 1.5 meters. The upper, intertidal section of the roots was colonized by barnacles (*Chthamalus sp.*, *Balanus sp.*). Shells of the Mangrove Oyster, *Crassostrea rhizophorae* were seen attached to the upper sections of the roots, but live oysters were not found. In general, mangrove root communities were depauperate. The cyanobacteria, *Dichotrix* sp. and red fleshy macroalgae (*Acanthophora spicifera, Hypnea cervicornis*) were the main sessile-benthic components of the mangrove roots. These were found growing throughout the length of the root. An unidentified orange sponge was observed attached to several roots, mostly in the upper 20 cms.

East Punta Colchones – Station 6

Along the east side of Punta Colchones the entire shoreline is formed by growth of Red Mangrove (Figure 2). Aerial roots reach towards the water expanding the mangrove islet and creating a marine habitat centered about the submerged roots. Submerged sections of aerial mangrove roots ranged from only a few centimeters at the surface to a depth of about 0.5 meter, for roots reaching the substrate. Turtle and Manatee Grasses form an extensive bed that grows all the way towards the mangrove shoreline. Also, large patches of the green macroalgae, *Caulerpa prolifera* were present at the mangrove-seagrass interface. The taxonomic composition of marine communities associated with the submerged mangrove roots East of Punta Colchones is presented in Table 8.

The submerged mangrove roots at the eastern section of Punta Colchones are largely within the intertidal range and therefore, mostly devoid of epibiota. Above the high tide water level or supra-littoral zone, the crab *Aratus pissoni*, a Xanthid crab and the gastropod, *Littorina angulifera* were present. The submerged roots were mostly

colonized by the cyanobacteria, *Dichotrix* sp. and fleshy green macroalgae (*Bryopsis* sp.). Sessile-benthic invertebrates attached to the roots included the Fire Sponge (*Tedania ignis*), barnacles (*Chthamalus sp, Balanus amphitrite*), ascidians (*Didemnum sp., Tridídemnum sp.*) and an encrusting bryozoan. Cyanobacteria was observed growing throughout the entire submerged section of roots and were the dominant biological component.

3.2 Mangrove Root Community Summary

A general reconnaissance of the marine communities associated with submerged mangrove roots were examined from a total of six stations in Jobos Bay during June, 2003. Mangrove stations east and west of Cayo Puerca presented submerged mangrove roots, but these were within the intertidal range and mostly devoid of epibenthic biota. Only films of the cyanobacteria, *Dichotrix* sp. and some red fleshy macroalgae (*Hypnea cervicornis*, *Acanthophora spicifera, Jania sp.*) were observed colonizing the small submerged section of the mangrove roots. Turtle and Manatee Grass were found growing all the way to the shoreline, reaching the mangrove roots in depths of less than 20 cms. No fish or motile-megabenthic invertebrates were observed from these stations.

Limited development of epibenthic communities associated with mangrove roots were observed at stations East of Punta Colchones, East of Cayo Puerca and at the backreef lagoons of Cayos Caribe and Cayo de Barca. These stations presented epibenthic communities largely dominated by growth of cyanobacteria, *Dichotrix* sp. and fleshy macroalgae. Epibenthic invertebrates associated with the submerged roots included sponges (mostly *Tedania ignis*) ascidians, bryozoans, polychaete worms and a few isolated stony coral colonies (e.g. *Favia fragum, Porites porites*). Supralittoral communities included populations of terrestrial crabs (e.g. *Aratus pisoni, Xantidae*), snails (e.g. *Littorina* spp.) and barnacles. In a previous assessment of submerged mangrove root communities from Jobos Bay, García and Castro (1997) observed that epibenthic biota increased in species richness and biomass towards the inner, more protected sections of Jobos Bay coastal lagoons. This may be related to conditions of higher productivity and slower current velocities inshore.

Submerged mangrove roots at the backreef of Cayos Caribe, Cayos de Barca and East Punta Colchones represent important nursery habitats for a diverse assemblage of juvenile reef fishes, estuarine residents and large adult predators. The submerged roots are the natural recruitment habitats of small sardines, such as the Dwarf Herring (*Jenkinsia lamprotaenia*) and anchovies (e.g. *Anchoa hepsetus*) which form large schooling aggregations under the mangrove canopy. These planktivore populations are the main prey for piscivorous juvenile reef fishes, including the Schoolmaster, Gray and Yellowtail Snappers (*Lutjanus apodus, L. griseus, Ocyurus chrysurus*), Bar Jack (*Carangoides ruber*) and Great Barracuda (*Sphyraena barracuda*). Also, these small schooling fishes serve as the main food item of the Brown Pelican (*Pelecanus occidentalis*). Other juvenile reef fishes present at the submerged mangrove root habitat of Cayos Caribes, Cayos de Barca and East Punta Colchones (e.g. Damselfishes, Grunts) use the habitat for protection and feed upon epibenthic biota attached to the mangrove roots. Resident fish populations at the submerged mangrove root habitat included several species of mojarras (*Eucinostomus sp., Gerres cinereus*), and the white mullet (*Mugil curema*). These are mostly demersal feeders of infaunal invertebrates and benthic algae typically associated with soft sediment substrates of high organic content.

4.0 Visual Surveys

4.1.1 Coral Reef Fishes

Cayo Caribes Reef 1

A total of 55 species of diurnal non-cryptic reef fishes were identified within belt-transect areas during our six visual surveys of Cayo Caribe (Table 9). Mean abundance of individuals within transect areas was 52.9 Ind/30 m^2 (range: 23.6 – 70.2 Ind/30 m^2). The mean number of species per transect was 16.4 (range: 9.0 - 20.4). Fish abundance at Caribes Reef was not significantly different from La Barca Reef, but higher than all other stations surveyed in Jobos Bay (ANOVA; $p < 0.001$, Appendix 1). Figure 3 displays the study mean fish abundance for reef stations surveyed. Caribe Reef presented a significantly higher (ANOVA; $p < 0.001$, Appendix 2) number of fish species per belt-transect than other stations surveyed from Jobos Bay (Figure 4).

The Bluehead Wrasse (*Thalassoma bifasciatum*) was the most abundant species within

transect areas with a study mean abundance of 13.2 Ind/30 m^2, or 24.9 % of the total individuals. The top eight species in terms of mean abundance (among a total of 14) were present during the six surveys, suggesting that they are year-round residents in the reef. An assemblage of seven species of Damselfishes (Pomacentridae) presented a combined abundance of 17.0 Ind/30 m^2, or 32.4 % of the total individuals.

Table 9. Taxonomic composition and abundance of fishes surveyed within belt-transects at Caribes Reef 2003 - 2004

Species	Common Name	Jun-03	Sep-03	Dec-03	Mar-04	May-04	Jul-04	MEAN	REL ABU (%)
Thalassoma bifasciatum	Blue-head Wrasse	5.4	13.6	27.2	8.0	12.0	12.8	**13.17**	24.9
Scarus iserti	Striped Parrotfish	1.8	9.4	5.4	6.8	6.2	5.6	**5.87**	11.1
Stegastes dorsopunicans	Dusky Damselfish	2.2	3.2	4.6	5.8	7.0	8.2	**5.17**	9.8
Stegastes partitus	Bicolor Damselfish	3.0	3.6	4.4	5.2	5.0	5.0	**4.37**	8.3
Stegastes leucostictus	Beaugregory	1.4	4.0	3.8	2.0	3.8	3.8	**3.13**	5.9
Chromis multilineata	Brown Chromis	4.4	1.4	1.2	3.8	3.2	3.4	**2.90**	5.5
Acanthurus chirurgus	Doctorfish	0.4	1.2	1.4	1.4	4.6	2.2	**1.87**	3.5
Ocyurus chrysurus	Yellowtail Snapper	1.0	3.6	2.2	0.4	0.4	1.2	**1.47**	2.8
Haemulon aurolineatum	Tomtate	0.0	0.4	0.2	3.2	2.2	1.2	**1.20**	2.3
Halichoeres maculipinna	Clown Wrasse	0.0	0.0	1.8	0.6	1.6	1.8	**0.97**	1.8
Holocentrus rufus	Squirrelfish	0.4	0.4	1.2	0.8	1.2	1.4	**0.90**	1.7
Haemulon flavolineatum	French Grunt	0.2	1.4	1.0	0.2	1.2	1.0	**0.83**	1.6
Microspathodon chrysurus	Yellowtail Damselfish	0.6	0.6	1.0	0.8	0.6	1.4	**0.83**	1.6
Acanthurus bahianus	Ocean Surgeon	0.2	0.6	1.2	0.6	1.2	1.0	**0.80**	1.5
Sparisoma aurofrenatum	Redband Parrotfish	0.4	0.4	0.6	1.4	0.8	1.2	**0.80**	1.5
Gobiosoma evelynae	Sharknose Goby	0.0	1.0	0.2	0.0	1.8	1.6	**0.77**	1.4
Halichoeres garnoti	Yellow head Wrasse	0.0	0.6	0.2	0.2	1.2	1.8	**0.67**	1.3
Malacoctenus triangulatus	Saddled Blenny	0.0	0.4	3.6	0.0	0.0	0.0	**0.67**	1.3
Sparisoma viride	Stoplight Parrotfish	0.4	1.0	0.8	0.2	0.4	1.2	**0.67**	1.3
Acanthurus coeruleus	Blue Tang	0.0	0.8	0.4	0.4	0.8	1.4	**0.63**	1.2
Serranus tigrinus	Harlequin Bass	0.0	0.2	0.8	0.4	0.6	1.0	**0.50**	0.9
Stegastes planifrons	Threespot Damselfish	1.6	0.0	1.0	0.4	0.0	0.0	**0.50**	0.9
Lutjanus apodus	Schoolmaster	0.0	0.8	0.2	0.0	0.6	0.4	**0.33**	0.6
Pomacanthus arcuatus	Gray Angelfish	0.0	0.8	0.4	0.0	0.6	0.0	**0.30**	0.6
Chromis cyanea	Blue Cromis	0.0	0.0	0.0	0.2	0.2	1.4	**0.30**	0.6
Halichoeres radiatus	Puddinwife	0.0	0.2	1.0	0.0	0.4	0.2	**0.30**	0.6
Lutjanus synagris	Lane Snapper	0.0	0.0	0.2	0.6	0.2	0.8	**0.30**	0.6
Myripristis jacobus	Black-bar Souldierfish	0.0	0.4	0.6	0.2	0.2	0.4	**0.30**	0.6
Sparisoma radians	Bucktooth Parrotfish	0.0	0.0	1.0	0.0	0.0	0.6	**0.27**	0.5
Sparisoma rubripinne	Yellowtail Parrotfish	0.0	0.2	0.2	0.2	0.2	0.4	**0.20**	0.4
Bodianus rufus	Spanish Hogfish	0.0	0.2	0.0	0.0	0.4	0.4	**0.17**	0.3
Cephalopholis cruentatus	Graysbe	0.0	0.0	0.6	0.0	0.2	0.2	**0.17**	0.3
Chaetodon capistratus	Four-eye Butterflyfish	0.0	0.0	0.0	0.2	0.0	0.8	**0.17**	0.3
Anisotremus virginicus	Porkfish	0.0	0.2	0.2	0.0	0.0	0.4	**0.13**	0.3
Chaetodon striatus	Banded Butterflyfish	0.0	0.2	0.0	0.0	0.4	0.2	**0.13**	0.3

Table 9. Taxonomic composition and abundance of fishes surveyed within belt-transects at Caribes Reef 2003 - 2004

Species	Common Name	Jun-03	Sep-03	Dec-03	Mar-04	May-04	Jul-04	MEAN	REL ABU (%)
Halichoeres bivittatus	Slippery Dick	0.0	0.0	0.2	0.4	0.2	0.0	**0.13**	0.3
Serranus baldwini	Lantern Bass	0.0	0.8	0.0	0.0	0.0	0.0	**0.13**	0.3
Holacanthus tricolor	Rock Beauty	0.0	0.0	0.0	0.2	0.2	0.2	**0.10**	0.2
Amblycirrhitus pinnos	Redspotted Hawkfish	0.0	0.2	0.0	0.0	0.2	0.0	**0.07**	0.1
Cantherhines pullus	Tail-light Filefish	0.0	0.0	0.0	0.2	0.2	0.0	**0.07**	0.1
Canthigaster rostrata	Caribbean Puffer	0.2	0.2	0.0	0.0	0.0	0.0	**0.07**	0.1
Haemulon macrostomum	Spanish Grunt	0.0	0.2	0.2	0.0	0.0	0.0	**0.07**	0.1
Holocentrus adsencionis	Longjaw Squirelfish	0.0	0.0	0.2	0.0	0.2	0.0	**0.07**	0.1
Pseudupeneus maculatus	Striped Goatfish	0.0	0.0	0.4	0.0	0.0	0.0	**0.07**	0.1
Scarus vetula	Queen Parrotfish	0.0	0.2	0.2	0.0	0.0	0.0	**0.07**	0.1
Coryphopterus sp.	Goby	0.0	0.2	0.0	0.0	0.0	0.0	**0.03**	0.1
Gymnothrorax funebris	Green Moray	0.0	0.0	0.0	0.2	0.0	0.0	**0.03**	0.1
Gymnothrorax moringa	Spotted Moray	0.0	0.0	0.2	0.0	0.0	0.0	**0.03**	0.1
Holacanthus ciliaris	Queen Angelfish	0.0	0.0	0.0	0.0	0.2	0.0	**0.03**	0.1
Hypoplectrus puella	Barred Hamlet	0.0	0.2	0.0	0.0	0.0	0.0	**0.03**	0.1
Lactophrys triqueter	Smooth Trunkfish	0.0	0.0	0.0	0.2	0.0	0.0	**0.03**	0.1
Lutjanus mahogany	Mahogany Snapper	0.0	0.0	0.0	0.0	0.2	0.0	**0.03**	0.1
Scarus taeniopterus	Princess Parrotfish	0.0	0.0	0.2	0.0	0.0	0.0	**0.03**	0.1
Sparisoma crysopterum	Red-tail Parrotfish	0.0	0.0	0.0	0.0	0.2	0.0	**0.03**	0.1
Sphyraena barracuda	Great Barracuda	0.0	0.2	0.0	0.0	0.0	0.0	**0.03**	0.1
	Total Individuals	**23.6**	**53.0**	**70.2**	**45.2**	**60.8**	**64.6**	**52.9**	100
	Total Species (55)	**16**	**36**	**38**	**30**	**38**	**33**	**31.8**	

Among damselfishes, the most abundant was the Dusky Damselfish (*Stegastes dorsopunicans*). Demersal damselfishes including the Bicolor, Dusky, Three-spot, Beaugregory and Yellowtail are mostly herbivorous and highly territorial on reef microhabitats. The Blue Chromis (*Chromis cyanea*) is a schooling damselfish that forms aggregations over coral heads and feeds mostly upon zooplankton. Parrotfishes (Scaridae) were also prominent components of the fish community at Cayo Caribes with eight species representing 15.1 % of the total individuals. The most abundant was the Striped Parrotfish (*Scarus iserti*) with a mean abundance of 5.9 Ind/30 m^2, or 11.1 % of the total individuals. Parrotfishes feed mostly upon benthic algae.

The herbivorous fish assemblage at Cayo Caribe was also represented by three species of doctorfishes (*Acanthurus spp.)*. Benthic invertebrate feeders were represented by the grunts (*Haemulon spp*), wrasses (*Thalassoma sp., Halichoeres spp.*), hamlets

(*Hypoplectrus spp*), squirrelfishes (*Holocentrus, Myripristis sp*), gobies (*Gobiosoma sp., Coryphopterus sp.*), small groupers (*Cephalopholis sp.*) and trunkfishes (*Lactophrys sp.*). Fish species of commercial value included the Yellowtail, Lane and Schoolmaster snappers, and Great Barracuda. These fishes represent the top carnivores of the reef.

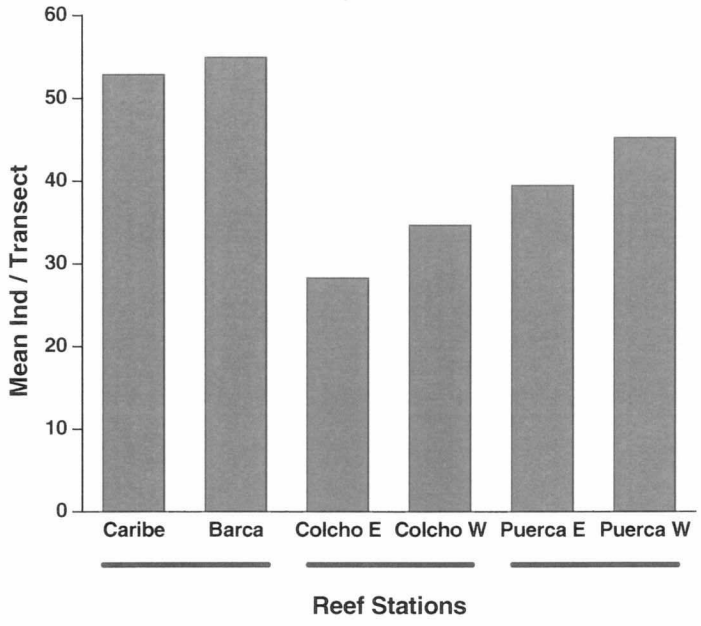

Figure 3. Mean number of fish individuals per transect at reef stations in Jobos Bay. Bars join stations with similar values of individuals/transect (ANOVA; $p < 0.05$)

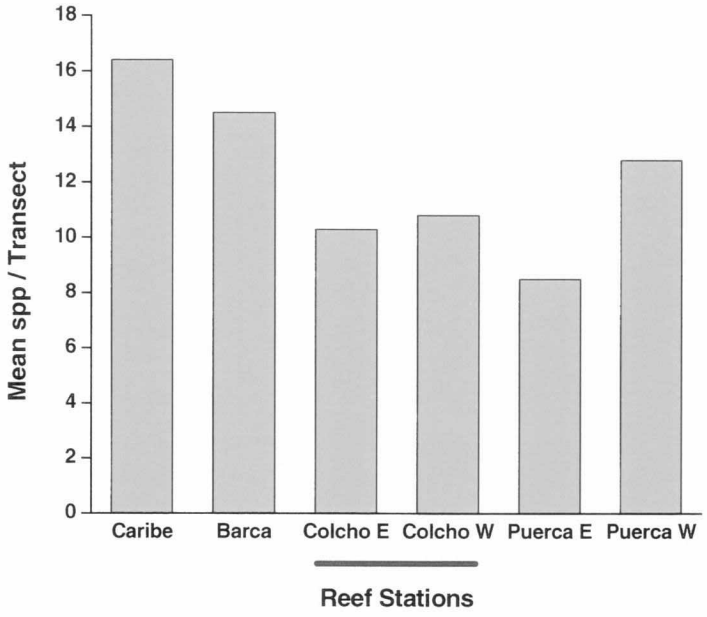

Figure 4. Mean number of fish species per transect at reef stations in Jobos Bay. Bars join stations with similar values of species/transect (ANOVA; $p < 0.05$)

Cayo La Barca Reef 2

The taxonomic composition and mean abundance of fishes surveyed at the reef crest of Cayos de Barca during the six sampling events is presented in Table 10. A total of 43 diurnal non-cryptic species, were identified within belt-transect areas. Fourteen out of the 43 fish species identified were observed at Cayo La Barca during the six surveys, suggesting that they are part of a rear-round resident fish assemblage. Mean abundance of individuals within transect areas was 55.0 Ind/30 m^2 (range : 43.4 – 84.6 Ind/30 m^2). La Barca presented significantly higher fish abundance than other reef stations (Figure 3), but was not different from Caribes (ANOVA; $p < 0.001$, Appendix 1). The number of species per transect was 14.5, significantly higher than all other stations surveyed except Cayo Caribes, which had significantly higher number of species/transect than La Barca (ANOVA; $p < 0.001$, Appendix 2).

The Bluehead Wrasse (*Thalassoma bifasciatum*) was the most abundant species within transect areas (mean : 13.4 Ind/30 m^2), representing 24.3 % of the total individuals. The Bicolor Damselfish (*Stegastes partitus*) and the Striped Parrotfish (*Scarus iserti*) ranked

second and third in terms of abundance. The combined abundance of these three numerically dominant species represented 60.5 % of the total individuals surveyed within transect areas during the six sampling events. An assemblage of six parrotfish species presented a combined abundance of 9.4 Ind/30 m^2, or 17.3 % of the total individuals. Fish species of commercial value included the Yellowtail and Schoolmaster snappers, and a juvenile Hogfish (*Lachnolaimus maximus*) observed outside transect areas.

West Cayo Puerca Reef 3

The taxonomic composition and abundance of fishes surveyed at the reef crest of West Cayo Puerca is presented in Table 11. A total of 47 diurnal non-cryptic species were identified within belt-transect areas. Mean abundance of individuals within transect areas was 45.3 Ind/30 m^2 (range : 31.2 – 70.0 Ind/30 m^2). Both fish abundance and the number of species per transect at West Cayo Puerca (Figures 3 and 4) was significantly higher than at Colchones, but lower than at Caribes and Barca Reefs (ANOVA; $p < 0.001$, Appendices 1-2).

Table 10. Taxonomic composition and abundance of fishes surveyed within belt-transects at La Barca Reef 2003 - 2004

Species	Common Name	Jun-03	Sep-03	Dec-03	Mar-04	May-04	Jul-04	MEAN	REL ABU (%)
Thalassoma bifasciatum	Blue-head Wrasse	6.6	15.4	30.4	12.8	5.2	9.8	**13.37**	24.3
Stegastes partitus	Bicolor Damselfish	9.6	7.8	14.6	13.0	14.6	15.4	**12.50**	22.8
Scarus iserti	Striped Parrotfish	3.6	11.6	14.6	3.8	5.6	4.8	**7.33**	13.4
Stegastes leucostictus	Beaugregory	5.0	4.0	3.4	1.8	3.4	3.0	**3.43**	6.3
Gobiosoma evelynae	Sharknose Goby	1.8	2.2	0.8	0.0	2.6	2.8	**1.70**	3.1
Halichoeres maculipinna	Clown Wrasse	0.6	1.2	2.4	0.6	3.0	2.4	**1.70**	3.1
Stegastes dorsopunicans	Dusky Damselfish	0.0	2.2	1.6	3.0	1.2	2.0	**1.67**	3.0
Halichoeres bivittatus	Slippery Dick	0.4	1.8	1.4	1.0	1.8	1.8	**1.37**	2.5
Sparisoma aurofrenatum	Redband Parrotfish	1.6	0.6	1.2	1.2	0.6	1.6	**1.13**	2.1
Acanthurus chirurgus	Doctorfish	0.2	0.8	0.4	0.2	2.6	2.0	**1.03**	1.9
Ocyurus chrysurus	Yellowtail Snapper	1.0	1.4	0.6	0.8	1.0	1.2	**1.00**	1.8
Chromis multilineata	Brown Chromis	0.2	0.0	3.6	0.6	0.2	1.0	**0.93**	1.7
Acanthurus coeruleus	Blue Tang	1.0	0.4	0.0	0.6	1.4	1.6	**0.83**	1.5
Serranus tigrinus	Harlequin Bass	0.8	1.2	0.8	0.2	1.0	1.0	**0.83**	1.5
Acanthurus bahianus	Ocean Surgeon	1.6	0.8	0.8	0.8	0.2	0.2	**0.73**	1.3
Malacoctenus triangulatus	Saddled Blenny	0.8	0.6	1.0	0.2	0.2	1.0	**0.63**	1.2
Chromis cyanea	Blue Cromis	0.0	0.4	2.2	0.0	0.4	0.8	**0.63**	1.2
Halichoeres garnoti	Yellow head Wrasse	0.8	0.4	0.4	0.2	0.4	1.0	**0.53**	1.0
Haemulon flavolineatum	French Grunt	0.2	0.2	0.2	0.8	0.4	0.6	**0.40**	0.7

Table 10. Taxonomic composition and abundance of fishes surveyed within belt-transects at La Barca Reef 2003 - 2004

Species	Common Name	Jun-03	Sep-03	Dec-03	Mar-04	May-04	Jul-04	MEAN	REL ABU (%)
Scaruis taeniopterus	Princess Parrotfish	1.2	0.8	0.2	0.0	0.0	0.0	**0.37**	0.7
Sparisoma viride	Stoplight Parrotfish	0.4	0.8	0.0	0.0	0.2	0.4	**0.30**	0.5
Cephalopholis cruentatus	Graysbe	0.0	0.2	0.4	0.0	0.4	0.6	**0.27**	0.5
Lutjanus apodus	Schoolmaster	0.0	0.0	0.0	0.4	0.6	0.6	**0.27**	0.5
Sparisoma radians	Bucktooth Parrotfish	0.4	0.0	1.0	0.2	0.0	0.0	**0.27**	0.5
Pseudupeneus maculatus	Spotted Goatfish	0.2	0.0	0.6	0.0	0.2	0.2	**0.20**	0.4
Amblycirrhitus pinnos	Redspotted Hawkfish	0.0	0.8	0.2	0.0	0.0	0.0	**0.17**	0.3
Halichoeres radiatus	Puddinwife	0.0	0.0	0.0	0.0	0.4	0.6	**0.17**	0.3
Holacanthus tricolor	Rock Beauty	0.2	0.2	0.2	0.2	0.0	0.2	**0.17**	0.3
Holocentrus rufus	Squirrelfish	0.0	0.2	0.0	0.2	0.2	0.4	**0.17**	0.3
Bodianus rufus	Spanish Hogfish	0.0	0.0	0.4	0.2	0.0	0.0	**0.10**	0.2
Cantherhines pullus	Tail-light Filefish	0.2	0.0	0.0	0.0	0.2	0.2	**0.10**	0.2
Haemulon sciurus	Blue-striped Grunt	0.0	0.0	0.0	0.2	0.2	0.2	**0.10**	0.2
Stegastes planifrons	Yellow-eye Damselfish	0.0	0.0	0.2	0.4	0.0	0.0	**0.10**	0.2
Chaetodon capistratus	Four-eye Butterflyfish	0.0	0.0	0.0	0.0	0.0	0.4	**0.07**	0.1
Chaetodon striatus	Banded Butterflyfish	0.0	0.0	0.4	0.0	0.0	0.0	**0.07**	0.1
Haemulon aurolineatum	Tomtate	0.0	0.0	0.0	0.0	0.0	0.4	**0.07**	0.1
Halichoeres poeyi	Black-ear Wrasse	0.0	0.0	0.0	0.0	0.4	0.0	**0.07**	0.1
Canthigaster rostrata	Caribbean Puffer	0.0	0.2	0.0	0.0	0.0	0.0	**0.03**	0.1
Haemulon macrostomum	Spanish Grunt	0.0	0.2	0.0	0.0	0.0	0.0	**0.03**	0.1
Hypoplectrus indigo	Indigo Hamlet	0.2	0.0	0.0	0.0	0.0	0.0	**0.03**	0.1
Hypoplectrus puella	Barred Hamlet	0.0	0.0	0.2	0.0	0.0	0.0	**0.03**	0.1
Sparisoma rubripinne	Yellowtail Parrotfish	0.0	0.0	0.2	0.0	0.0	0.0	**0.03**	0.1
Synodus intermedius	Lizardfish	0.0	0.0	0.2	0.0	0.0	0.0	**0.03**	0.1
	Total Individuals	**38.6**	**56.4**	**84.6**	**43.4**	**48.6**	**58.2**	**55.0**	**100**
	Total Species (43)	**24**	**26**	**30**	**24**	**28**	**30**	**27.0**	

The fish community was comprised by a rich assemblage of juvenile reef fishes and adult herbivores, such as damselfishes, parrotfishes and doctorfishes. Twelve species, including the four most abundant were observed during the six sampling events, suggesting that these are year-round residents of West Cayo Puerca Reef. The Striped Parrotfish (*Scarus iserti*) and the Dusky Damselfish (*Stegastes dorsopunicans*), with a mean abundance of 11.6 and 11.2 Ind/30 m^2, respectively, were the numerically dominant species, representing 50.4 % of the study mean fish abundance (Table 11). Parrotfishes (Scaridae), represented by seven species within transect areas were the most specious fish assemblage. Parrotfishes presented a combined abundance of 17.2 Ind/30 m^2, or 38.0 % of the study mean fish abundance. A school of large Rainbow Parrotfishes (*Scarus guacamaia*) was observed to be resident at this reef. Doctorfishes,

with three species represented 7.3 % of the total study mean fish abundance. Small epibenthic invertebrate feeders were represented by wrasses (*Thalassoma sp., Halichoeres spp.*), hamlets (*Hypoplectrus spp*), squirrelfishes (*Holocentrus spp.*) and juvenile grunts (*Haemulon spp.*). Schoolmaster, Gray and Yellowtail snappers (*Lutjanus apodus, L. griseus, O. chrysurus*) were the only commercially important fishes observed at West Cayo Puerca Reef.

East Cayo Puerca Reef 4

The taxonomic composition and abundance of fishes surveyed at the reef crest of East Cayo Puerca is presented in Table 12. A total of 38 diurnal non-cryptic species, were identified within belt-transects. Mean abundance of fish individuals within transect areas was 39.5 Ind/30 m^2 (range : 22.2 – 54.8 Ind/30 m^2, see Figure 3). Fish abundance at East Cayo Puerca was significantly lower than at Caribes and Barca reefs, but higher than East and West Colchones (ANOVA; $p < 0.001$, Appendix 1). The number of fish species per transect, however, was lower than at East and West Colchones (ANOVA; $p < 0.001$, Appendix 2).

The fish community was mostly comprised by herbivorous taxa, such as damselfishes, parrotfishes and doctorfishes. The Dusky Damselfish (*Stegastes dorsopunicans*), with a mean abundance of 13.5 Ind/30 m^2 was the numerically dominant species, representing 34.3 % of the total individuals. The Striped Parrotfish (*Scarus iserti*) was the other

Table 11. Taxonomic composition and abundance of fishes surveyed within belt-transects at West Cayo Puerca Reef, 2003 - 2004

Species	Common Name	Jun-03	Sep-03	Dec-03	Mar-04	May-04	Jul-04	MEAN	REL ABU (%)
Scarus iserti	Striped Parrotfish	4.4	3.6	28.4	15.4	8.4	9.6	**11.63**	25.7
Stegastes dorsopunicans	Dusky Damselfish	11.2	9	10.2	9	14.2	13.6	**11.20**	24.7
Acanthurus coeruleus	Blue Tang	2	0.4	4.2	1.2	2.4	1.6	**1.97**	4.3
Sparisoma viride	Stoplight Parrotfish	1.6	1.4	3.8	2.2	1	1.6	**1.93**	4.3
Haemulon sp. (juv.)	Juvenile Grunts	0	0	3.2	2.8	1.2	2.6	**1.63**	3.6
Sparisoma rubripinne	Yellowtail Parrotfish	1	1.8	1.4	1.4	1.2	2.2	**1.50**	3.3
Stegastes leucostictus	Beaugregory	1.8	2.4	1.4	1.4	0.8	1.2	**1.50**	3.3
Haemulon flavolineatum	French Grunt	0.2	1	2.4	1.2	1.6	2	**1.40**	3.1
Sparisoma radians	Bucktooth Parrotfish	0.6	1	1.8	3.4	0.8	0.8	**1.40**	3.1
Acanthurus chirurgus	Doctorfish	0.4	1.8	1.8	0.8	0.8	1.6	**1.20**	2.6
Lutjanus apodus	Schoolmaster	2.4	0.6	1.6	0.8	0.8	1	**1.20**	2.6

Table 11. Taxonomic composition and abundance of fishes surveyed within belt-transects at West Cayo Puerca Reef, 2003 - 2004

Species	Common Name	Jun-03	Sep-03	Dec-03	Mar-04	May-04	Jul-04	MEAN	REL ABU (%)
Abudefduf sexatilis	Sargeant Major	1.4	0	0.6	0.8	0.6	1.2	**0.77**	1.7
Thalassoma bifasciatum	Blue-head Wrasse	0.8	0.4	0.4	2	0.8	0	**0.73**	1.6
Haemulon melanorum	Cottonwick	0	0	1.6	1	0	1.4	**0.67**	1.5
Microspathodon chrysurus	Yellowtail Damselfish	0	1.4	0.6	1	0.4	0.6	**0.67**	1.5
Ocyurus chrysurus	Yellowtail Snapper	0	1	0.4	1	0.4	1	**0.63**	1.4
Anisotremus virginicus	Porkfish	0.4	0.4	0.2	0	1.6	0.8	**0.57**	1.3
Chaetodon capistratus	Four-eye Butterflyfish	0	0.2	0.8	0.8	0.8	0.4	**0.50**	1.1
Holocentrus rufus	Squirrelfish	0.4	1	0.2	0.2	0.4	0.6	**0.47**	1.0
Scarus guacamaia	Rainbow Parrotfish	0	0	0.4	1	0.6	0.6	**0.43**	1.0
Labrisomus nuchipinnis	Hairy Blenny	0.4	0.2	0.4	0.4	0.2	0.6	**0.37**	0.8
Halichoeres poeyi	Black-ear Wrasse	0	0	0	1.2	0.6	0.2	**0.33**	0.7
Lutjanus griseus	Gray Snapper	0	0	1.2	0.8	0	0	**0.33**	0.7
Halichoeres bivittatus	Slippery Dick	0	0	0.2	1	0	0.6	**0.30**	0.7
Halichoeres maculipinna	Clown Wrasse	0	0.4	0	0	0.2	1	**0.27**	0.6
Sparisoma aerofrenatum	Redband Parrotfish	0.2	0	0	1.2	0	0	**0.23**	0.5
Acanthurus bahianus	Ocean Surgeon	0.2	0	0.4	0	0.4	0	**0.17**	0.4
Haemulon carbonarium	Caesar Grunt	0.4	0	0.6	0	0	0	**0.17**	0.4
Haemulon plumieri	White Grunt	0.2	0	0.4	0	0.2	0	**0.13**	0.3
Hypoplectrus puella	Barred Hamlet	0	0	0.4	0.4	0	0	**0.13**	0.3
Chaetodon striatus	Banded Butterflyfish	0	0	0.4	0	0.2	0	**0.10**	0.2
Halichoeres radiatus	Puddinwife	0	0	0	0	0.2	0.4	**0.10**	0.2
Hypoplectrus indigo	Indigo Hamlet	0	0.2	0	0	0.4	0	**0.10**	0.2
Anisotremus surinamensis	Black Margate	0	0.2	0	0	0.2	0	**0.07**	0.1
Sparisoma chrysopterum	Redtail Parrotfish	0	0	0	0.4	0	0	**0.07**	0.1
Carangoides ruber	Bar Jack	0.2	0	0	0	0	0	**0.03**	0.1
Caranx bartholomei	Yellow Jack	0.2	0	0	0	0	0	**0.03**	0.1
Diodon holacanthus	Ballonfish	0	0	0.2	0	0	0	**0.03**	0.1
Diodon hystrix	Porcupinefish	0.2	0	0	0	0	0	**0.03**	0.1
Eucinostomus sp.	Mojarra	0	0	0.2	0	0	0	**0.03**	0.1
Gobiosoma evelynae	Sharknose Goby	0.2	0	0	0	0	0	**0.03**	0.1
Haemulon ascensionis	Longspine Squirrelfish	0.2	0	0	0	0	0	**0.03**	0.1
Haemulon sciurus	BlueStriped Grunt	0	0.2	0	0	0	0	**0.03**	0.1
Hypoplectrus chlorurus	Yellowtail Hamlet	0	0	0.2	0	0	0	**0.03**	0.1
Pomacanthus arcuatus	Gray Angelfish	0	0	0	0	0.2	0	**0.03**	0.1
Scorpaena plumieri	Spotted Scorpionfish	0	0.2	0	0	0	0	**0.03**	0.1
Stegastes variabilis	Cocoa Damselfish	0.2	0	0	0	0	0	**0.03**	0.1
	Total Individuals	**31.2**	**28.8**	**70**	**52.8**	**41.6**	**47.2**	**45.3**	100
	Total Species (47)	**25**	**22**	**31**	**27**	**29**	**24**	**26.3**	

numerically dominant species with a mean abundance of 8.0 Ind/30 m^2, representing 20.3 % of the mean fish abundance during the study period. Parrotfishes (Scaridae)

were the most specious fish assemblage with a total of six species present within transect areas. The combined abundance parrotfishes and damselfishes represented approximately 66.0 % of the total individuals. Small epibenthic invertebrate feeders were represented by wrasses (*Thalassoma sp., Halichoeres spp.*), hamlets (*Hypoplectrus spp*) and trunkfishes (*Lactophrys sp.*). Juvenile Schoolmaster and Gray snappers (*Lutjanus apodus, L. griseus*) were observed within transects, representing, along with squirrelfishes (*Holocentrus rufus*), grunts (*Haemulon spp.*) and croakers (*Odontoscion sp.*) the main carnivorous assemblage at East Cayo Puerca Reef.

West Punta Colchones Reef 5

A total of 42 diurnal non-cryptic species were identified within belt-transect areas at West Punta Colchones Reef (Table 13). Mean abundance of individuals within transect areas was 34.7 Ind/30 m^2 (range : 22.6 – 46.8 Ind/30 m^2). Fish abundance (Figure 3) was significantly lower than at Caribes, Barca and Puerca Reefs (ANOVA; $p < 0.001$, Appendix 1). The number of fish species per transect (Figure 4) was significantly higher than at East Puerca, but lower than at other reefs surveyed (ANOVA; $p < 0.001$, Appendix 2).

Table 12. Taxonomic composition and abundance of fishes surveyed within belt-transects at East Cayo Puerca Reef, 2003 - 2004

Species	Common Name	Jun-03	Sep-03	Dec-03	Mar-04	May-04	Jul-04	MEAN	REL ABU (%)
Stegastes dorsopunicans	Dusky Damselfish	15.6	11.4	17.4	6.0	15.2	15.6	**13.53**	34.3
Scarus iserti	Striped Parrotfish	0.0	5.2	14.2	3.2	12.6	13.0	**8.03**	20.3
Atherinomorus sp.	Silverside	0.0	20.0	0.0	0.0	0.0	0.0	**3.33**	8.4
Haemulon sp. (juv.)	Juvenile Grunts	0.0	2.2	9.4	1.6	0.0	2.2	**2.57**	6.5
Acanthurus coeruleus	Blue Tang	0.2	0.0	0.4	0.4	5.8	1.2	**1.33**	3.4
Haemulon flavolineatum	French Grunt	0.4	2.6	2.0	0.0	0.8	1.6	**1.23**	3.1
Haemulon melanorum	Cottonwick	0.0	0.0	0.8	2.0	2.6	2.0	**1.23**	3.1
Sparisoma radians	Bucktooth Parrotfish	0.2	3.0	1.2	1.0	0.0	0.4	**0.97**	2.4
Sparisoma viride	Stoplight Parrotfish	0.2	0.8	1.4	0.0	1.2	1.6	**0.87**	2.2
Stegastes leucostictus	Beaugregory	0.4	0.6	0.2	0.8	0.6	1.0	**0.60**	1.5
Microspathodon chrysurus	Yellowtail Damselfish	0.8	0.2	0.8	0.0	0.8	0.8	**0.57**	1.4
Scarus taeniopterus	Princess Parrotfish	2.4	0.0	0.4	0.4	0.0	0.0	**0.53**	1.4
Sparisoma rubripinne	Yellowtail Parrotfish	0.0	0.6	0.6	0.4	0.6	0.8	**0.50**	1.3
Lutjanus apodus	Schoolmaster	0.4	0.2	0.4	0.2	0.8	0.8	**0.47**	1.2
Acanthurus chirurgus	Doctorfish	0.2	1.2	0.4	0.6	0.2	0.0	**0.43**	1.1
Abudefduf sexatilis	Sargeant Major	0.6	0.0	0.0	0.0	0.8	1.0	**0.40**	1.0

Table 12. Taxonomic composition and abundance of fishes surveyed within belt-transects at East Cayo Puerca Reef, 2003 - 2004

Species	Common Name	Jun-03	Sep-03	Dec-03	Mar-04	May-04	Jul-04	MEAN	REL ABU (%)
Thalassoma bifasciatum	Blue-head Wrasse	0.0	0.0	0.6	0.0	0.4	0.8	**0.30**	0.8
Anisotremus surinamensis	Black Margate	0.0	0.2	0.0	1.4	0.0	0.0	**0.27**	0.7
Haemulon plumieri	White Grunt	0.2	0.0	0.0	0.2	1.2	0.0	**0.27**	0.7
Haemulon sciurus	BlueStriped Grunt	0.0	0.2	1.2	0.0	0.0	0.0	**0.23**	0.6
Holocentrus rufus	Squirrelfish	0.4	0.6	0.0	0.0	0.2	0.2	**0.23**	0.6
Ocyurus chrysurus	Yellowtail Snapper	0.0	0.4	1.0	0.0	0.0	0.0	**0.23**	0.6
Hypoplectrus puella	Barred Hamlet	0.0	0.2	0.4	0.2	0.0	0.4	**0.20**	0.5
Carangoides ruber	Bar Jack	0.0	0.0	0.0	0.0	0.0	1.0	**0.17**	0.4
Lutjanus griseus	Gray Snapper	0.0	0.2	0.0	0.0	0.4	0.4	**0.17**	0.4
Chaetodon capistratus	Four-eye Butterflyfish	0.0	0.2	0.4	0.0	0.2	0.0	**0.13**	0.3
Haemulon carbonarium	Caesar Grunt	0.0	0.0	0.4	0.0	0.2	0.2	**0.13**	0.3
Acanthurus bahianus	Ocean Surgeon	0.0	0.0	0.0	0.6	0.0	0.0	**0.10**	0.3
Halichoeres poeyi	Black-ear Wrasse	0.0	0.0	0.4	0.0	0.0	0.0	**0.07**	0.2
Hypoplectrus indigo	Indigo Hamlet	0.0	0.0	0.0	0.0	0.2	0.2	**0.07**	0.2
Labrisomus nuchipinnis	Hairy Blenny	0.0	0.0	0.0	0.0	0.0	0.4	**0.07**	0.2
Sparisoma aurofrenatum	Redband Parrotfish	0.0	0.0	0.2	0.2	0.0	0.0	**0.07**	0.2
Alutherus scriptus	Scrawled Filefish	0.0	0.0	0.2	0.0	0.0	0.0	**0.03**	0.1
Halichoeres bivittatus	Slippery Dick	0.0	0.0	0.2	0.0	0.0	0.0	**0.03**	0.1
Holacanthus ciliaris	French Angelfish	0.2	0.0	0.0	0.0	0.0	0.0	**0.03**	0.1
Lactophrys bicaudalis	Spotted Trunkfish	0.0	0.0	0.2	0.0	0.0	0.0	**0.03**	0.1
Odontoscion dentex	Reef Croaker	0.0	0.0	0.0	0.2	0.0	0.0	**0.03**	0.1
Pomacanthus paru	French Angelfish	0.0	0.0	0.0	0.0	0.2	0.0	**0.03**	0.1
	Total Individuals	**22.2**	**50.0**	**54.8**	**19.4**	**45.0**	**45.6**	**39.5**	100
	Total Species (38)	**14**	**19**	**24**	**17**	**20**	**21**	**19.2**	

As in other sections of this fringing reef crest environment, herbivorous fishes, such as damselfishes, parrotfishes and doctorfishes comprised the bulk of individuals in the community. A total of seven species within these three families were observed during the six surveys at this station, suggesting that they are part of a year-round resident fish assemblage at this station.

The Dusky Damselfish (*Stegastes dorsopunicans*) and the Striped Parrotfish (*Scarus iserti*), with mean abundances of 7.9 and 7.4 Ind/30 m^2, were the numerically dominant species, representing 44.2 % of the study mean fish abundance for the station. Parrotfishes (Scaridae), were represented by nine species within transect areas and presented a combined abundance of 12.1 Ind/30 m^2, or 35.6 % of the total individuals. They were the most specious and abundant fish assemblage at West Punta Colchones

Reef. Doctorfishes (*Acanthurus spp.*), with three species presented a combined abundance of 2.4 Ind/30 m^2, or 6.7 % of the total individuals. Among small carnivorous taxa, the wrasses (Labridae) with five species (*Thalassoma, Halichoeres spp.*) presented a combined abundance of 3.5 Ind/30 m^2, or 10.0 % of the total individuals. Juvenile Schoolmaster Snapper (*Lutjanus apodus*) and Tomtates (*Haemulon aurolineatum*), were also present within transect areas and represent additional components of the reef carnivorous assemblage. As previously discussed for other sections of Punta Colchones Reef, juvenile reef fishes appear to use the shallow reef and seagrass (interface) habitats as nursery areas given the availability of reef protective habitat and available food sources in the seagrass bed.

East Punta Colchones Reef 6

A total of 37 diurnal non-cryptic species were identified within belt-transect areas at East Punta Colchones Reef (Table 14). Mean abundance of individuals within transect areas was 28.3 Ind/30 m^2 (range : 14.4 – 42.6 Ind/30 m^2). Fish abundance (Figure 3) was significantly lower than at Caribes, Barca and Puerca Reefs (ANOVA; $p < 0.001$, Appendix 1). The number of fish species per transect (Figure 4) was significantly higher than at East Puerca, but lower than at other reefs surveyed (ANOVA; $p < 0.001$, Appendix 2).

Table 13. Taxonomic composition and abundance of fishes surveyed within belt-transects at West Punta Colchones Reef, 2003 – 2004

Species	Common Name	Jun-03	Sep-03	Dec-03	Mar-04	May-04	Jul-04	MEAN	REL ABU (%)
Stegastes dorsopunicans	Dusky Damselfish	4.2	8.4	8.0	5.0	12.8	9.0	**7.90**	22.8
Scarus iserti	Striped Parrotfish	8.2	2.0	11.2	5.6	7.8	9.8	**7.43**	21.4
Haemulon sp. (juv.)	Juvenile Grunts	0.0	2.4	7.4	0.4	2.0	3.4	**2.60**	7.5
Sparisoma rubripinne	Yellowtail Parrotfish	1.2	1.4	1.6	1.6	2.6	2.6	**1.83**	5.3
Haemulon flavolineatum	French Grunt	0.0	0.6	0.0	1.0	4.4	2.2	**1.37**	3.9
Sparisoma viride	Stoplight Parrotfish	0.4	0.8	0.6	0.6	2.2	2.2	**1.13**	3.3
Ocyurus chrysurus	Yellowtail Snapper	0.0	0.0	4.6	1.0	0.2	1.0	**1.13**	3.3
Sparisoma radians	Bucktooth Parrotfish	1.0	2.2	2.6	0.6	0.2	0.0	**1.10**	3.2
Acanthurus chirurgus	Doctorfish	1.4	2.8	0.2	1.2	0.4	0.4	**1.07**	3.1
Halichoeres bivittatus	Slippery Dick	0.6	0.8	1.2	0.0	1.6	1.6	**0.97**	2.8
Stegastes leucostictus	Beaugregory	0.4	0.8	1.2	0.4	0.8	1.2	**0.80**	2.3
Thalassoma bifasciatum	Blue-head Wrasse	1.0	1.0	0.0	1.6	0.4	0.8	**0.80**	2.3

Table 13. Taxonomic composition and abundance of fishes surveyed within belt-transects at West Punta Colchones Reef, 2003 – 2004

Species	Common Name	Jun-03	Sep-03	Dec-03	Mar-04	May-04	Jul-04	MEAN	REL ABU (%)
Acanthurus coeruleus	Blue Tang	0.6	0.2	1.0	0.4	1.2	1.2	**0.77**	2.2
Haemulon sciurus	BlueStriped Grunt	0.0	1.0	0.8	0.0	2.4	0.0	**0.70**	2.0
Lutjanus apodus	Schoolmaster	0.4	0.6	0.6	0.0	0.8	0.8	**0.53**	1.5
Halichoeres maculipinna	Clown Wrasse	1.6	1.0	0.4	0.0	0.0	0.0	**0.50**	1.4
Acanthurus bahianus	Ocean Surgeon	1.0	1.2	0.0	0.4	0.4	0.0	**0.50**	1.4
Halichoeres poeyi	Black-ear Wrasse	0.0	0.0	1.6	0.4	0.4	0.2	**0.43**	1.2
Chaetodon capistratus	Four-eye Butterflyfish	0.6	0.4	0.2	0.4	0.2	0.6	**0.40**	1.2
Labrisomus nuchipinnis	Hairy Blenny	0.2	0.6	0.6	0.2	0.0	0.6	**0.37**	1.1
Scarus taeniopterus	Princess Parrotfish	0.0	0.0	0.8	0.6	0.6	0.0	**0.33**	1.0
Haemulon melanorum	Cottonwick	0.0	0.0	0.8	0.8	0.0	0.0	**0.27**	0.8
Sparisoma aurofrenatum	Redband Parrotfish	1.0	0.2	0.0	0.2	0.0	0.0	**0.23**	0.7
Carangoides ruber	Bar-Jack	0.0	1.4	0.0	0.0	0.0	0.0	**0.23**	0.7
Holocentrus rufus	Squirrelfish	0.0	0.0	0.2	0.0	0.4	0.6	**0.20**	0.6
Hypoplectrus puella	Barred Hamlet	0.0	0.0	0.4	0.0	0.2	0.4	**0.17**	0.5
Sparisoma chrysopterum	Redtail Parrotfish	0.0	0.6	0.0	0.0	0.0	0.2	**0.13**	0.4
Hemipteronotus sp.	Razorfish	0.0	0.0	0.6	0.0	0.0	0.0	**0.10**	0.3
Scarus vetula	Queen Parrotfish	0.2	0.0	0.0	0.0	0.2	0.0	**0.07**	0.2
Pomacanthus ciliaris	French Angelfish	0.0	0.0	0.0	0.0	0.2	0.2	**0.07**	0.2
Hypoplectrus unicolor	Butter Hamlet	0.0	0.0	0.2	0.0	0.0	0.2	**0.07**	0.2
Hypoplectrus indigo	Indigo Hamlet	0.0	0.0	0.0	0.0	0.2	0.2	**0.07**	0.2
Aulostomus maculatus	Trumpetfish	0.0	0.2	0.0	0.0	0.2	0.0	**0.07**	0.2
Anisotremus virginicus	Porkfish	0.0	0.2	0.0	0.0	0.0	0.2	**0.07**	0.2
Chaetodon striatus	Banded Butterflyfish	0.0	0.2	0.0	0.0	0.0	0.0	**0.03**	0.1
Scarus chrysopterum	Red-tail Parrotfish	0.0	0.0	0.0	0.0	0.2	0.0	**0.03**	0.1
Pomacanthus paru	French Angelfish	0.0	0.2	0.0	0.0	0.0	0.0	**0.03**	0.1
Odontoscion dentex	Reef Croaker	0.0	0.0	0.0	0.2	0.0	0.0	**0.03**	0.1
Lachnolaimus maximus	Hogfish	0.2	0.0	0.0	0.0	0.0	0.0	**0.03**	0.1
Haemulon aurolineatum	Tomtate	0.2	0.0	0.0	0.0	0.0	0.0	**0.03**	0.1
Gymnothorax funebris	Green Moray	0.0	0.0	0.0	0.0	0.2	0.0	**0.03**	0.1
Diodon histrix	Porcupinefish	0.0	0.0	0.0	0.0	0.2	0.0	**0.03**	0.1
	Total Individuals	**24.4**	**31.2**	**46.8**	**22.6**	**43.4**	**39.6**	**34.7**	100
	Total Species (42)	**19**	**25**	**23**	**20**	**28**	**23**	**23.0**	

The fish community was mostly comprised by an assemblage of juvenile and adult herbivores, such as damselfishes, parrotfishes and doctorfishes. The Dusky Damselfish (*Stegastes dorsopunicans*) and Striped Parrotfish (*Scarus iserti*), with mean abundances of 6.2 and 5.9 Ind/30 m^2 , respectively, were the numerically dominant species, representing 42.6 % of the study fish mean abundance at East Punta Colchones Reef. Parrotfishes (Scaridae), represented by seven species within transect areas were the most specious fish assemblage. Parrotfishes presented a combined abundance of 9.8

Ind/30 m^2, or 34.6 % of the study fish mean abundance. Doctorfishes, with three species presented a combined abundance of 2.2 Ind/30 m^2, or 7.5 % of the total individuals. The six most abundant species were present during the six sampling events, suggesting that they constitute part of a year-round resident assemblage at this reef. Juvenile Yellowtail Snapper (*Ocyurus chrysurus*) and Tomtates (*Haemulon aurolineatum*) were identified within transect areas and observed to be common at the base of the reef. These juvenile reef fishes appear to use the shallow reef and seagrass (interface) habitats as nursery areas. The Hairy Blenny (*Labrisomus nuchipinnis*) occupies small crevices within the rubble at East Punta Colchones Reef. Due to its cryptic behavior, the reported abundance is probably underestimated by the survey method. Small epibenthic invertebrate feeders, such as the grunts (*Haemulon spp.*), blennies (*Labrisomus sp.*) and wrasses (*Thalassoma sp., Halichoeres spp.*) comprised the small carnivorous fish assemblage of the reef. Fish species of commercial value included the Yellowtail, Lane, Gray and Schoolmaster snappers, Hogfish and Great Barracuda. These fishes represent the top carnivores of the reef.

Table 14. Taxonomic composition and abundance of fishes surveyed within belt-transects at Punta Colchones East Reef, 2003 - 2004

Species	Common Name	Jun-03	Sep-03	Dec-03	Mar-04	May-04	Jul-04	MEAN	REL ABU (%)
Stegastes dorsopunicans	Dusky Damselfish	5.6	6.4	5	4	10	6	**6.17**	21.8
Scarus iserti	Striped Parrotfish	2.2	0.2	13.4	2.6	4.2	12.8	**5.90**	20.8
Acanthurus chirurgus	Doctorfish	0.4	1.4	1	0.8	3.4	1.2	**1.37**	4.8
Thalassoma bifasciatum	Blue-head Wrasse	0.2	0.6	1.8	2.2	1.6	1.4	**1.30**	4.6
Sparisoma radians	Bucktooth Parrotfish	1.6	1.2	2.4	1.4	0.2	0.8	**1.27**	4.5
Sparisoma rubripinne	Yellowtail Parrotfish	0.2	0.8	1.6	1.4	1.6	2	**1.27**	4.5
Haemulon flavolineatum	French Grunt	0	1.4	1.4	2.4	0.2	1.2	**1.10**	3.9
Sparisoma viride	Stoplight Parrotfish	0.6	0.8	1.4	0.4	1	1.6	**0.97**	3.4
Halichoeres maculipinna	Clown Wrasse	0	0	0.8	2.8	0.6	1	**0.87**	3.1
Lutjanus griseus	Mangrove Snapper	0	0	2.6	0.6	0.4	1.4	**0.83**	2.9
Haemulon sp. (juv.)	Juvenile Grunts	0	2.6	0.2	1.8	0	0	**0.77**	2.7
Halichoeres bivittatus	Slippery Dick	0	0.4	1.8	0	1.2	0.8	**0.70**	2.5
Lutjanus apodus	Schoolmaster	0	0.8	0.4	0.4	1.2	1	**0.63**	2.2
Stegastes leucostictus	Beaugregory	0.4	0	0.8	0.8	0.8	1	**0.63**	2.2
Chaetodon capistratus	Four-eye Butterflyfish	0	0.4	1.6	1	0.6	0	**0.60**	2.1
Ocyurus chrysurus	Yellowtail Snapper	0.2	0.2	1.4	0	0.2	0.8	**0.47**	1.6
Halichoeres poeyi	Black-ear Wrasse	0	0	1.4	1	0.2	0	**0.43**	1.5
Acanthurus bahianus	Ocean Surgeon	0.8	0	0.4	0.2	0.2	0.8	**0.40**	1.4
Abudefduf sexatilis	Sargeant Major	0	0	0	0	1	1.2	**0.37**	1.3
Acanthurus coeruleus	Blue Tang	0.6	0	0.2	0.2	0.4	0.8	**0.37**	1.3
Haemulon plumieri	White Grunt	0.4	0.6	1.2	0	0	0	**0.37**	1.3

Table 14. Taxonomic composition and abundance of fishes surveyed within belt-transects at Punta Colchones East Reef, 2003 - 2004

Species	Common Name	Jun-03	Sep-03	Dec-03	Mar-04	May-04	Jul-04	MEAN	REL ABU (%)
Labrisomus nuchipinnis	Hairy Blenny	0.4	0.2	0.2	0.2	0.2	0.4	**0.27**	0.9
Haemulon sciurus	Blue-Striped Grunt	0	0	0.2	1.2	0	0	**0.23**	0.8
Sparisoma aurofrenatum	Redband Parrotfish	0.2	0	0	0.2	0.2	0.4	**0.17**	0.6
Anisotremus virginicus	Porkfish	0.2	0.2	0	0.2	0	0	**0.10**	0.4
Hypoplectrus puella	Barred Hamlet	0	0	0.2	0	0	0.4	**0.10**	0.4
Sparisoma chrysopterum	Redtail Parrotfish	0	0.2	0	0.4	0	0	**0.10**	0.4
Scarus taeniopterus	Princess Parrotfish	0	0	0.6	0	0	0	**0.10**	0.4
Diodon histrix	Porcupinefish	0.2	0	0	0.2	0	0	**0.07**	0.2
Hypoplectrus indigo	Indigo Hamlet	0	0	0	0.4	0	0	**0.07**	0.2
Lutjanus synagris	Lane Snapper	0	0	0	0	0	0.4	**0.07**	0.2
Odontoscion dentex	Reef Croaker	0	0	0.2	0	0	0.2	**0.07**	0.2
Sphyraena barracuda	Geat Barracuda	0	0	0.2	0.2	0	0	**0.07**	0.2
Haemulon aurolineatum	Tomtate	0.2	0	0	0	0	0	**0.03**	0.1
Lachnolaimus maximus	Hogfish	0	0.2	0	0	0	0	**0.03**	0.1
Myripristis jacobus	Black-bar Souldierfish	0	0	0	0	0.2	0	**0.03**	0.1
Scorpaena plumieri	Spotted Scorpionfish	0	0	0.2	0	0	0	**0.03**	0.1
	Total Individuals	**14.4**	**18.6**	**42.6**	**27**	**29.6**	**37.6**	**28.3**	100
	Total Species (37)	**17**	**18**	**27**	**25**	**21**	**22**	**21.7**	

4.1.2 Seagrass Fishes

Punta Rodeo

The taxonomic composition and mean abundance of fishes observed within belt-transects at the seagrass habitat of Punta Rodeo is presented in Table 15. Mean fish abundance was 1.3 Ind/30m^2 (range: 0.6 – 3.0 Ind/30m^2). Rodeo seagrass station presented significantly lower fish abundance (Figure 5) and number of fish species per transect (Figure 6) than other sampling stations except Colchones East, which was not different from Rodeo (ANOVA; $p < 0.001$; Appendices 3 - 4).

Only five fish species were observed during the six surveys. The Bucktooth Parrotfish (*Sparisoma radians*) was the most abundant species, representing 61.5 % of the study mean fish abundance at this station and the only species that was observed within transect areas in all six surveys. The Razorfish (*Hemipteronotus sp.*) was observed during four surveys and along with the Bucktooth Parrotfish appears to be a year-round resident of this seagrass habitat. Early juveniles (3-6 cm TL) of the Yellowtail Snapper (*Ocyurus chrysurus*) were detected during three sampling events.

Table 15. Fish taxonomic composition and abundance from Pta Rodeo- Seagrass 1

		2003		2004					REL
Species	**Common Name**	**Jun**	**Sep**	**Dec**	**Mar**	**May**	**Jul**	**MEAN**	**ABU (%)**
Sparisoma radians	Bucktooth Parrotfish	2	0.2	0.4	0.4	0.8	1	0.80	61.5
Ocyurus chrysurus	Yellowtail Snapper	1	0.2	0	0	0	0.2	0.23	17.9
Hemipteronotus sp.	Razorfish	0	0	0.2	0.2	0.4	0.4	0.20	15.4
Diodon holacanthus	Ballonfish	0	0	0	0	0.2	0	0.03	2.6
Sphyraena barracuda	Great Barracuda	0	0	0	0	0.2	0	0.03	2.6
	Total Individuals	**3**	**0.4**	**0.6**	**0.6**	**1.6**	**1.6**	**1.30**	100
	Total Species (5)	**2**	**2**	**2**	**2**	**4**	**3**	**2.50**	

Pájaros

The taxonomic composition and mean abundance of fishes observed within belt-transects at the seagrass habitat of Isla de Pájaros is presented in Table 16. Fish abundance at Pájaros (mean: 4.7 Ind/30 m^2) was significantly higher than at Rodeo and East Colchones (Figure 5), but lower than at Cayo Puerca and Colchones Channel (ANOVA; $p < 0.001$; Appendix 3). The mean number of fish species per transect at Pájaros (2.5 species/transect) was significantly higher than at Rodeo and East Colchones (Figure 6), but similar to other stations surveyed in Jobos Bay (ANOVA; $p < 0.001$; Appendix 4).

A total of 18 fish species were present during the six surveys. Juvenile grunts (*Haemulon spp.*) were the most abundant fishes (mean: 1.4 Ind/30 m^2), representing 29.1 % of the study mean fish abundance at this station. The Bucktooth Parrotfish (*Sparisoma radians*) ranked second in mean abundance (1.3 Ind/30 m^2) and along with juvenile grunts was present in all six surveys performed. Juvenile parrotfishes (*Sparisoma spp*), Yellowtail Snappers (*Ocyurus chrysurus*) and Barracuda (*Sphyraena barracuda*) were present in this seagrass habitat. The occurrence of several reef fishes, including the Ocean Surgeon, Barred Hamlet, Four-eye Butterflyfish, Beaugregory and the Slippery Dick is an indication that coral heads and/or other hard ground habitat is available in the seagrass bed, stimulating fish species diversity and abundance. The two mojarras are transitory species that forage for infaunal and small epibenthic invertebrates within the seagrass and adjacent soft sediment habitats. The Black-ear Wrasse and the Razorfish are adult residents of seagrass habitats that appear to occur in low abundance at Isla the Pájaros.

Table 16. Fish taxonomic composition and abundance at Pajaros - Seagrass 2.

		2003			2004				REL
Species	**Common Name**	**Jun**	**Sep**	**Dec**	**Mar**	**May**	**Jul**	**MEAN**	**ABU (%)**
Haemulon sp.	Juvenile Grunts	0.4	1	1.8	2.4	1.4	1.2	**1.37**	29.1
Sparisoma radians	Bucktooth Parrotfish	0.2	1.2	2.8	0.2	2.4	0.8	**1.27**	27.0
Ocyurus chrysurus	Yellowtail Snapper	0	0.2	1	0	0.6	0.6	**0.40**	8.5
Sparisoma sp.	Juvenile Parrotfishes	0	2	0	0	0	0	**0.33**	7.1
Acanthurus bahianus	Ocean Surgeon	0	0	0	0	0.4	1.4	**0.30**	6.4
Halichoeres poeyi	Black-ear Wrasse	0	0	1	0	0.6	0	**0.27**	5.7
Gerres cinereus	Yellowfin Mojarra	0	0	0	0	0.2	0.6	**0.13**	2.8
Halichoeres bivittatus	Slippery Dick	0	0	0.2	0	0.4	0	**0.10**	2.1
Scarus iserti	Striped Parrotfish	0	0.4	0	0	0	0	**0.07**	1.4
Sphaeroides testudineus	Puffer	0	0	0.4	0	0	0	**0.07**	1.4
Sphyraena barracuda	Great Barracuda	0	0.2	0	0	0	0.2	**0.07**	1.4
Stegastes leucostictus	Beaugregory	0	0	0.2	0	0.2	0	**0.07**	1.4
Chaetodon capistratus	Four-eye Butterflyfish	0	0	0.2	0	0.2	0	**0.07**	1.4
Diodon holacanthus	Ballonfish	0	0	0.2	0	0	0	**0.03**	0.7
Eucinostomus sp.	Mojarra	0	0	0.2	0	0	0	**0.03**	0.7
Hemipteronotus sp.	Razorfish	0	0.2	0	0	0	0	**0.03**	0.7
Hypoplectrus puella	Barred Hamlet	0	0	0.2	0	0	0	**0.03**	0.7
Pseudupeneus maculatus	Striped Goatfish	0	0	0	0	0.2	0	**0.03**	0.7
	Total Individuals	**0.6**	**5.2**	**8.2**	**2.6**	**6.6**	**4.8**	**4.7**	100.0
	Total Species (18)	**2**	**7**	**11**	**2**	**10**	**5**	**6.2**	**6.9**

Cayo Puerca

The taxonomic composition and mean abundance of fishes observed within belt-transects at the seagrass habitat of Cayo Puerca is presented in Table 17. Fish abundance at Cayo Puerca (mean: 5.9 Ind/30 m^2) was significantly lower than at Colchones Channel (Figure 5), but higher than at all other seagrass stations (ANOVA; $p < 0.001$; Appendix 3). The mean number of fish species per transect at Cayo Puerca (2.6 species/transect) was significantly higher than at Rodeo and East Colchones (Figure 6), but similar to other stations surveyed (ANOVA; $p < 0.001$; Appendix 4).

Seagrass fish residents, such as the Bucktooth Parrotfish (*Sparisoma radians*) and the Razorfish (*Hemipteronotus* sp.) were the numerically dominant fish taxa at Cayo Puerca seagrass (Table 17). Both of these species were present within the belt-transect during the six surveys. The Black-ear Wrasse is another resident adult species that was observed at this habitat. Juvenile reef fishes present at Cayo Puerca seagrass include

grunts (*Haemulon sp.*) and the Yellowtail Snapper (*Ocyurus chrysurus*). The occurrence of juvenile Yellowtail Snappers during the six sampling events suggests that reproduction and recruitment of this species is continuous throughout the year. Abundance and richness of fish species was observed to be highest at the interface between the seagrass and the fringing reef environment

Table 17. Taxonomic composition and abundance of fishes at Cayo Puerca Seagrass

		2003			2004				REL
Species	**Common Name**	**Jun**	**Sep**	**Dec**	**Mar**	**May**	**July**	**Mean**	**ABU (%)**
Sparisoma radians	Bucktooth Parrotfish	2.0	1.4	1.0	0.4	2.0	1.6	**1.40**	23.7
Hemipteronotus sp.	Razorfish	2.0	0.4	0.4	0.4	1.8	1.8	**1.13**	19.2
Ocyurus chrysurus	Yellowtail Snapper	1.0	0.6	0.6	0.4	1.2	1.2	**0.83**	14.1
Haemulon sp.	Juvenile Grunts	4.0	0.0	0.0	0.0	0.0	0.0	**0.67**	11.3
Scarus iserti	Striped Parrotfish	0.0	0.0	0.4	0.0	0.6	1.6	**0.43**	7.3
Halichoeres maculipinna	Clown Wrasse	0.0	0.0	0.0	0.4	0.6	1.4	**0.40**	6.8
Stegastes leucostictus	Beaugregory	2.0	0.0	0.2	0.0	0.0	0.0	**0.37**	6.2
Acanthurus bahianus	Ocean Surgeon	0.0	0.0	0.0	0.2	0.2	1.0	**0.23**	4.0
Halichoeres poeyi	Black-ear Wrasse	0.0	0.4	0.2	0.0	0.0	0.6	**0.20**	3.4
Holocentrus rufus	Squirrelfish	1.0	0.0	0.0	0.0	0.0	0.0	**0.17**	2.8
Eucinostomus sp.	Mojarra	0.0	0.0	0.2	0.0	0.0	0.0	**0.03**	0.6
Halichoeres bivittatus	Slippery Dick	0.0	0.0	0.2	0.0	0.0	0.0	**0.03**	0.6
	Total Individuals	**12.0**	**2.8**	**3.2**	**1.8**	**6.4**	**9.2**	**5.9**	100
	Total Species (12)	**6**	**4**	**8**	**5**	**6**	**7**	**6.0**	

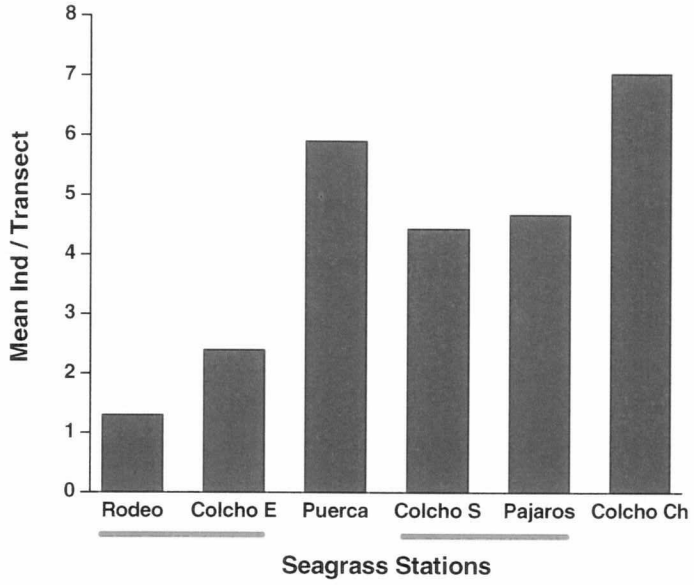

Figure 5. Mean abundance of fish individuals per transect at seagrass stations in Jobos Bay. Bars join stations with similar values of Individuals/transect (ANOVA; $p < 0.05$).

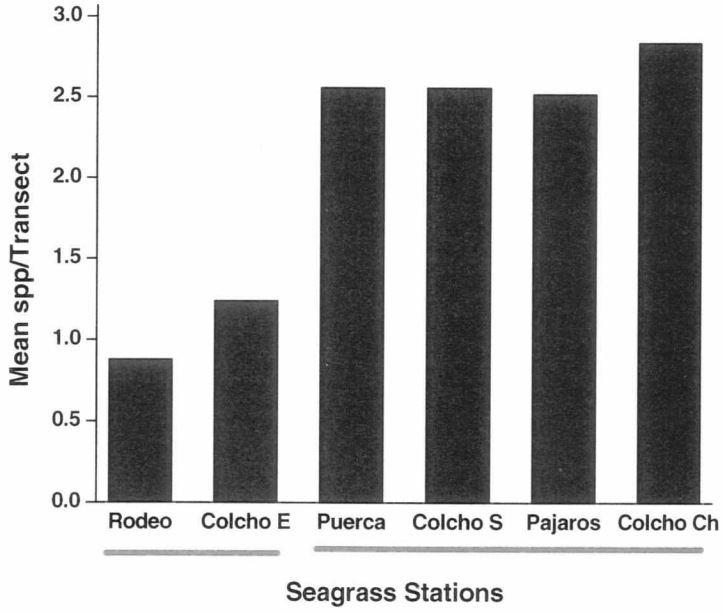

Figure 6. Mean number of fish species per transect at seagrass stations in Jobos Bay. Bars join stations with similar values of fish species/transect (ANOVA; $p < 0.05$).